

This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found [here](#).

If you have a suggestion to make the keys better, please fill out the short survey [here](#).

*Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.*

1. Choose the interval below that  $f$  composed with  $g$  at  $x = -2$  is in.

$$f(x) = -2x^3 - 4x^2 + x - 1 \text{ and } g(x) = -2x^3 - 3x^2 + x$$

The solution is  $-31.0$ , which is option B.

A.  $(f \circ g)(-2) \in [31, 36]$

Distractor 3: Corresponds to being slightly off from the solution.

B.  $(f \circ g)(-2) \in [-34, -26]$

\* This is the correct solution

C.  $(f \circ g)(-2) \in [24, 26]$

Distractor 1: Corresponds to reversing the composition.

D.  $(f \circ g)(-2) \in [-38, -35]$

Distractor 2: Corresponds to being slightly off from the solution.

E. It is not possible to compose the two functions.

**General Comment:**  $f$  composed with  $g$  at  $x$  means  $f(g(x))$ . The order matters!

2. Choose the interval below that  $f$  composed with  $g$  at  $x = -1$  is in.

$$f(x) = 4x^3 + 4x^2 - 2x \text{ and } g(x) = 2x^3 - 2x^2 - 3x - 1$$

The solution is  $-12.0$ , which is option B.

A.  $(f \circ g)(-1) \in [-2, 7]$

Distractor 1: Corresponds to reversing the composition.

B.  $(f \circ g)(-1) \in [-17, -9]$

\* This is the correct solution

C.  $(f \circ g)(-1) \in [5, 16]$

Distractor 3: Corresponds to being slightly off from the solution.

D.  $(f \circ g)(-1) \in [-8, -1]$

Distractor 2: Corresponds to being slightly off from the solution.

E. It is not possible to compose the two functions.

**General Comment:**  $f$  composed with  $g$  at  $x$  means  $f(g(x))$ . The order matters!

3. Determine whether the function below is 1-1.

$$f(x) = (5x - 26)^3$$

The solution is yes, which is option A.

- A. Yes, the function is 1-1.

\* This is the solution.

- B. No, because the range of the function is not  $(-\infty, \infty)$ .

Corresponds to believing 1-1 means the range is all Real numbers.

- C. No, because there is a  $y$ -value that goes to 2 different  $x$ -values.

Corresponds to the Horizontal Line test, which this function passes.

- D. No, because there is an  $x$ -value that goes to 2 different  $y$ -values.

Corresponds to the Vertical Line test, which checks if an expression is a function.

- E. No, because the domain of the function is not  $(-\infty, \infty)$ .

Corresponds to believing 1-1 means the domain is all Real numbers.

**General Comment:** There are only two valid options: The function is 1-1 OR No because there is a  $y$ -value that goes to 2 different  $x$ -values.

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4. Find the inverse of the function below. Then, evaluate the inverse at  $x = 10$  and choose the interval that  $f^{-1}(10)$  belongs to.

$$f(x) = e^{x-3} - 5$$

The solution is  $f^{-1}(10) = 5.708$ , which is option A.

- A.  $f^{-1}(10) \in [5.61, 5.73]$

This is the solution.

- B.  $f^{-1}(10) \in [-3.24, -2.83]$

This solution corresponds to distractor 4.

- C.  $f^{-1}(10) \in [-0.54, -0.06]$

This solution corresponds to distractor 1.

- D.  $f^{-1}(10) \in [-3.66, -3.28]$

This solution corresponds to distractor 2.

- E.  $f^{-1}(10) \in [-2.64, -2.19]$

This solution corresponds to distractor 3.

**General Comment:** Natural log and exponential functions always have an inverse. Once you switch the  $x$  and  $y$ , use the conversion  $e^y = x \leftrightarrow y = \ln(x)$ .

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5. Find the inverse of the function below (if it exists). Then, evaluate the inverse at  $x = -14$  and choose the interval that  $f^{-1}(-14)$  belongs to.

$$f(x) = \sqrt[3]{2x - 5}$$

The solution is  $-1369.5$ , which is option A.

A.  $f^{-1}(-14) \in [-1373.5, -1362.5]$

\* This is the correct solution.

B.  $f^{-1}(-14) \in [1371.5, 1375.5]$

This solution corresponds to distractor 3.

C.  $f^{-1}(-14) \in [1369.5, 1370.5]$

This solution corresponds to distractor 2.

D.  $f^{-1}(-14) \in [-1374.5, -1371.5]$

Distractor 1: This corresponds to

E. The function is not invertible for all Real numbers.

This solution corresponds to distractor 4.

**General Comment:** Be sure you check that the function is 1-1 before trying to find the inverse!

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6. Find the inverse of the function below. Then, evaluate the inverse at  $x = 5$  and choose the interval that  $f^{-1}(5)$  belongs to.

$$f(x) = e^{x-2} - 2$$

The solution is  $f^{-1}(5) = 3.946$ , which is option A.

A.  $f^{-1}(5) \in [3.7, 4.98]$

This is the solution.

B.  $f^{-1}(5) \in [-0.07, 1.7]$

This solution corresponds to distractor 1.

C.  $f^{-1}(5) \in [-0.93, -0.88]$

This solution corresponds to distractor 2.

D.  $f^{-1}(5) \in [-0.93, -0.88]$

This solution corresponds to distractor 4.

E.  $f^{-1}(5) \in [-0.07, 1.7]$

This solution corresponds to distractor 3.

**General Comment:** Natural log and exponential functions always have an inverse. Once you switch the  $x$  and  $y$ , use the conversion  $e^y = x \leftrightarrow y = \ln(x)$ .

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7. Find the inverse of the function below (if it exists). Then, evaluate the inverse at  $x = 10$  and choose the interval that  $f^{-1}(10)$  belongs to.

$$f(x) = 4x^2 - 5$$

The solution is The function is not invertible for all Real numbers. , which is option E.

A.  $f^{-1}(10) \in [0.71, 1.71]$

Distractor 2: This corresponds to finding the (nonexistent) inverse and not subtracting by the vertical shift.

B.  $f^{-1}(10) \in [3.05, 4.01]$

Distractor 3: This corresponds to finding the (nonexistent) inverse and dividing by a negative.

C.  $f^{-1}(10) \in [4.69, 5.8]$

Distractor 4: This corresponds to both distractors 2 and 3.

D.  $f^{-1}(10) \in [1.81, 2.61]$

Distractor 1: This corresponds to trying to find the inverse even though the function is not 1-1.

E. The function is not invertible for all Real numbers.

\* This is the correct option.

**General Comment:** Be sure you check that the function is 1-1 before trying to find the inverse!

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8. Multiply the following functions, then choose the domain of the resulting function from the list below.

$$f(x) = 9x + 7 \text{ and } g(x) = \sqrt{-3x - 9}$$

The solution is The domain is all Real numbers less than or equal to  $x = -3.0$ , which is option B.

A. The domain is all Real numbers greater than or equal to  $x = a$ , where  $a \in [-6.33, -0.33]$

B. The domain is all Real numbers less than or equal to  $x = a$ , where  $a \in [-6, 0]$

C. The domain is all Real numbers except  $x = a$ , where  $a \in [2.33, 8.33]$

D. The domain is all Real numbers except  $x = a$  and  $x = b$ , where  $a \in [-7.83, -1.83]$  and  $b \in [1.2, 7.2]$

E. The domain is all Real numbers.

**General Comment:** The new domain is the intersection of the previous domains.

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9. Determine whether the function below is 1-1.

$$f(x) = -12x^2 - 167x - 575$$

The solution is no, which is option D.

A. No, because the domain of the function is not  $(-\infty, \infty)$ .

Corresponds to believing 1-1 means the domain is all Real numbers.

B. No, because the range of the function is not  $(-\infty, \infty)$ .

Corresponds to believing 1-1 means the range is all Real numbers.

C. Yes, the function is 1-1.

Corresponds to believing the function passes the Horizontal Line test.

D. No, because there is a  $y$ -value that goes to 2 different  $x$ -values.

\* This is the solution.

E. No, because there is an  $x$ -value that goes to 2 different  $y$ -values.

Corresponds to the Vertical Line test, which checks if an expression is a function.

**General Comment:** There are only two valid options: The function is 1-1 OR No because there is a  $y$ -value that goes to 2 different  $x$ -values.

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10. Add the following functions, then choose the domain of the resulting function from the list below.

$$f(x) = 3x^4 + 6x^3 + 4x^2 + 5x \text{ and } g(x) = \sqrt{-6x - 18}$$

The solution is The domain is all Real numbers less than or equal to  $x = -3.0$ ., which is option C.

- A. The domain is all Real numbers greater than or equal to  $x = a$ , where  $a \in [-8.83, -0.83]$
- B. The domain is all Real numbers except  $x = a$ , where  $a \in [5.33, 6.33]$
- C. The domain is all Real numbers less than or equal to  $x = a$ , where  $a \in [-7, 1]$
- D. The domain is all Real numbers except  $x = a$  and  $x = b$ , where  $a \in [-1.17, 4.83]$  and  $b \in [5.25, 11.25]$
- E. The domain is all Real numbers.

**General Comment:** The new domain is the intersection of the previous domains.

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